installation / operation manual

# M500 Series
# Two / Four Wire
# Ultrasonic Level Measurement Systems

Magne-Sonic
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## UNPACKING INSTRUCTIONS

Remove the Packing List and verify that you have received all equipment, including the following (quantities in parentheses):

Ultrasonic Level Measurement System (1)

Operator's Manual (1)

If you have any questions about the shipment, please call the Magne-Sonic Customer Service Department. When you receive the shipment, inspect the container and equipment for signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

> *Note:*
> *The carrier will not honor damage claims unless all shipping material is saved for inspection. After examining and removing contents, save packing material and carton in the event reshipping is necessary.*

# SYSTEM DESCRIPTIONS 1

## GENERAL DESCRIPTION

The MS500 Series Two / Four Wire Series Liquid Level systems are state-of-the-art level measurement instruments. Based on the latest ultrasonic technology, the MS500 Series provide an efficient, reliable and cost effective means of level control.

The MS500 Series consists of two major components, a non-contacting ultrasonic sensor and a compact, integral electronic control.

The unit is available in a variety of sizes and materials to suit virtually any application. Standard mounting configurations include 3/4" and 2" NPT fittings. Flange mounting is also available to meet user specifications. Sensor material construction includes 316SS, Kynar or Teflon.

# PRINCIPLES OF OPERATION 2

## PRINCIPLES OF OPERATION

In operation, the electronics generate an electronic signal which is converted by the sensor (mounted on the top of the vessel) to a burst of ultrasonic pulses. These pulses are transmitted through the air toward the liquid surface. As the pulses reach the liquid surface, they are reflected back to the sensor. Those received echoes are converted back to an electronic signal which is then sent to the microprocessor. The microprocessor uses the return signals to calculate the time it takes for the pulses to travel to the liquid surface and back. This "Time of Flight" is directly proportional to the distance of the liquid surface from the sensor. The microprocessor then compares these calculated values with user programmed system parameters to provide the required control outputs.

## CONTROL UNIT INSTALLATION

1. Open the control unit enclosure and remove the printed circuit board.
2. Replace printed circuit board and route power and control wiring to the enclosure. Observe all applicable local electrical codes and wiring procedures.
3. Connect power and control wiring to the control unit as shown in Wiring Diagram (see figures 2 and 3).
4. Be sure that all wiring is carefully dressed to prevent pinching between the housing and the cover.

## SENSOR INSTALLATION

The sensor is mounted on the top of the vessel with the sensor facing downward. A clear path, free of any obstructions must be provided between the sensor and the liquid surface. Due to the narrow sensor beam pattern, vertical axis positioning of the sensor is important. The sensor must be installed perpendicular to the liquid surface.

1. For a sensor provided with an NPT threaded fitting, drill a suitable hole in the vessel top and tap for the correct NPT thread. In thin walled vessels, or vessels constructed of material not suitable for tapping, weld or braze a bushing to accept the sensor.
2. Screw the sensor into the threaded fitting being careful not to cross thread the sensor. When possible, the use of a pipe compound or sealing tape is recommended. AVOID OVER TIGHTENING!
3. For flange mounted sensors, simply bolt the sensor / flange assembly to the proper mating flange connection.
4. Route the sensor cable to the electronic control unit and connect per the Wiring Diagram (see figures 2 and 3). IF ROUTING THE SENSOR CABLE THROUGH CONDUIT, A DEDICATED CONDUIT SHOUT BE UTILIZED. AVOID ROUTING THE SENSOR CABLE IN CLOSE PROXIMITY TO ANY SOURCE OF ALTERNATING CURRENT OR RFI.

*CAUTION: DO NOT ATTEMPT TO REMOVE A THREADED SENSOR FROM THE VESSEL WITH THE CABLE ATTACHED TO THE CONTROL UNIT, OTHERWISE IT MAY DAMAGE CABLE.*

## WIRING

Note: All wiring between the power supply and the transmitter should be accomplished with 18 AWG to 22 AWG shielded twisted pair. The connection is made at the terminal strip within the transmitter enclosure. Before you connect the power line to the transmitter, be sure that the voltage identification on the nameplate matches the power supply. DO NOT attempt to operate this unit at voltages other than as identified or it will damage the unit.

*CAUTION:UNITS ARE DESIGNED TO OPERATE ON DC POWER ONLY. APPLICATION OF 120 VAC WILL DAMAGE THE INSTRUMENT.*

1. Make sure the power source is turned off.
2. Pull power supply wires through conduit connection.
3. Connect the positive supply wire to the (+) terminal, and the negative supply wire to the (-) terminal. Refer to Wiring Diagram (Figures 2 and 3).
4. Replace the transmitter housing cover until it is time to calibrate.
5. Connect the positive supply wire to the positive terminal of the power source.

# 4 PROGRAMMING DESCRIPTION

## GENERAL

The MS500 Two Wire, Four Wire are calibrated via BCD switches. All data entered during the calibration procedure is stored in a nonvolatile memory to prevent loss of data in the event of a power failure.

## CALIBRATION PROCEDURE

Unscrew the control unit cover and use the following procedures:

1. Dial **ZERO** setting though "top BCD switches" in increments of 1" up to 360" (30 feet) (special units can be set to an increment of 0.1" up to a span of 99.9") (e.g.: 12" can be set as **012** on BCD switches).
2. Dial **SPAN** setting through "bottom BCD Switches" in increments of 1" to 360" (30 feet) (special units can be set to an increment of 0.1" up to a span of 99.9") (e.g.: 12" can be set as **120** on BCD switches).
3. Set **"JP1"** jumper for height/distance mode

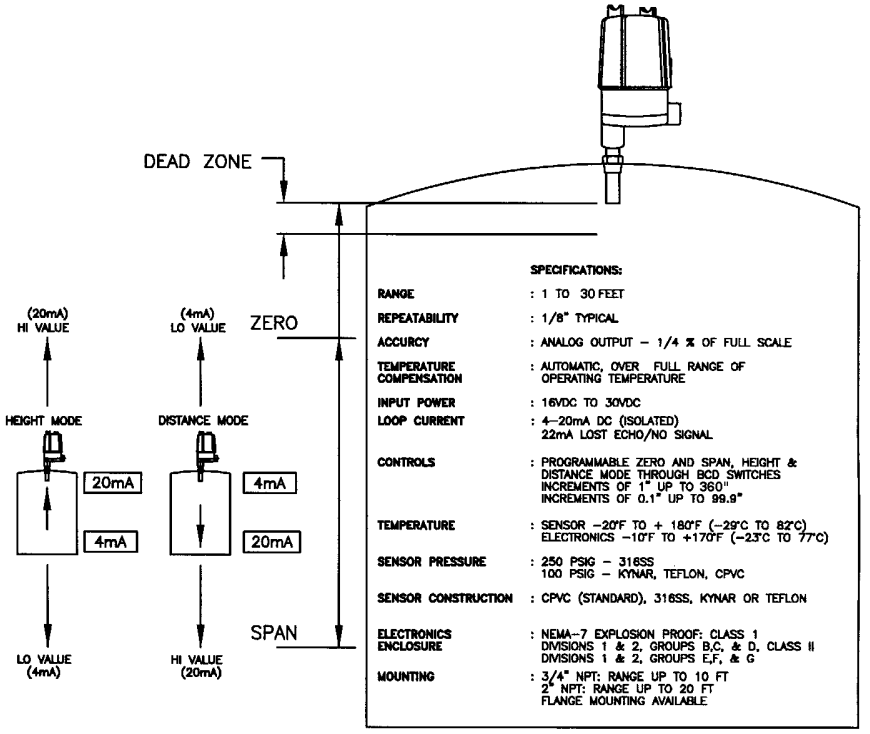
   Height Mode: Zero Setting: 20mA
   Span Setting: 4mA

   Distance Mode: Zero Setting: 4mA
   Span Setting: 20mA

4. Turn on the power, the unit is ready for operation.

   While the cover is unscrewed, observe lost echo LED. If the unit has not detected a reliable echo for over 10 seconds, the LED will turn on and the unit will draw approximately 22mA indicating an error condition.

# Figure 1




**SPECIFICATIONS:**

| | |
|---|---|
| **RANGE** | : 1 TO 30 FEET |
| **REPEATABILITY** | : 1/8" TYPICAL |
| **ACCURCY** | : ANALOG OUTPUT – 1/4 % OF FULL SCALE |
| **TEMPERATURE COMPENSATION** | : AUTOMATIC, OVER FULL RANGE OF OPERATING TEMPERATURE |
| **INPUT POWER** | : 16VDC TO 30VDC |
| **LOOP CURRENT** | : 4–20mA DC (ISOLATED)<br>22mA LOST ECHO/NO SIGNAL |
| **CONTROLS** | : PROGRAMMABLE ZERO AND SPAN, HEIGHT & DISTANCE MODE THROUGH BCD SWITCHES<br>INCREMENTS OF 1" UP TO 360"<br>INCREMENTS OF 0.1" UP TO 99.9" |
| **TEMPERATURE** | : SENSOR –20°F TO + 180°F (–29°C TO 82°C)<br>ELECTRONICS –10°F TO +170°F (–23°C TO 77°C) |
| **SENSOR PRESSURE** | : 250 PSIG – 316SS<br>100 PSIG – KYNAR, TEFLON, CPVC |
| **SENSOR CONSTRUCTION** | : CPVC (STANDARD), 316SS, KYNAR OR TEFLON |
| **ELECTRONICS ENCLOSURE** | : NEMA–7 EXPLOSION PROOF: CLASS 1 DIVISIONS 1 & 2, GROUPS B,C, & D. CLASS II DIVISIONS 1 & 2, GROUPS E,F, & G |
| **MOUNTING** | : 3/4" NPT: RANGE UP TO 10 FT<br>2" NPT: RANGE UP TO 20 FT<br>FLANGE MOUNTING AVAILABLE |

ANALOG OUTPUT SYSTEM

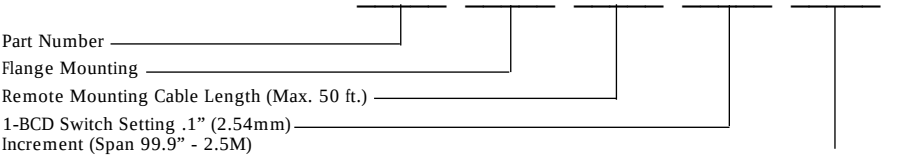
NOTES:

1) ZERO CALIBRATED IN INCHES FROM FACE OF SENSOR
2) SPAN CALIBRATED IN INCHES FROM THE ZERO POINT
3) ALARM POINTS CALIBRATED IN INCHES FROM FACE OF SENSOR
4) THE SYSTEM RANGE EQUALS ZERO PLUS SPAN IN INCHES

# Ordering System

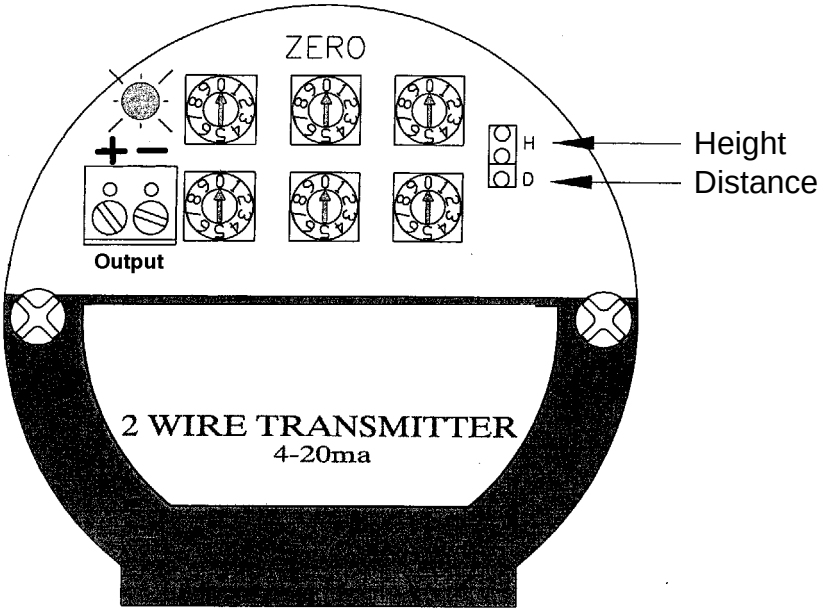
| P/N | RANGE LIQUID SLURRY | RANGE BULK SOLID | ELECTRONICS | SENSOR MATERIAL | SENSOR MOUNTING |
|---|---|---|---|---|---|
| **MS516** | 6" - 120" (.15M - 3M) | 6" - 60" (.15M - 1.5M) | **2 Wire, Loop Power** | **316LSS** | 3/4" NPT |
| **MS517** | 6" - 120" (.15M - 3M) | 6" - 60" (.15M - 1.5M) | **2 Wire, Loop Power** | **316LSS** | Sanitary 1" |
| **MS518** | 6" - 120" (.15M - 3M) | 6" - 60" (.15M - 1.5M) | **2 Wire, Loop Power** | **316LSS** | Sanitary 1 1/2" |
| **MS519** | 6" - 120" (.15M - 3M) | 6" - 60" (.15M - 1.5M) | **2 Wire, Loop Power** | **316LSS** | Sanitary 2" |
| **MS520** | 6" - 120" (.15M - 3M) | 6" - 60" (.15M - 1.5M) | **2 Wire, Loop Power** | **Teflon** | 3/4" NPT |
| **MS521** | 6" - 120" (.15M - 3M) | 6" - 60" (.15M - 1.5M) | **2 Wire, Loop Power** | **Teflon** | Sanitary 1" |
| **MS522** | 6" - 120" (.15M - 3M) | 6" - 60" (.15M - 1.5M) | **2 Wire, Loop Power** | **Teflon** | Sanitary 1 1/2" |
| **MS523** | 6" - 120" (.15M - 3M) | 6" - 60" (.15M - 1.5M) | **2 Wire, Loop Power** | **Teflon** | Sanitary 2" |
| **MS524** | 6" - 120" (.15M - 3M) | 6" - 60" (.15M - 1.5M) | **2 Wire, Loop Power** | **Tefzel** | 3/4" NPT |
| **MS525** | 6" - 120" (.15M - 3M) | 6" - 60" (.15M - 1.5M) | **2 Wire, Loop Power** | **Kynar** | 3/4" NPT |
| **MS526** | 6" - 120" (.15M - 3M) | 6" - 60" (.15M - 1.5M) | **2 Wire, Loop Power** | **CPVC** | 3/4" NPT |
| **MS527** | 12" - 300" (.3M - 6M) | 12" - 120" (.3M - 3M) | **2 Wire, Loop Power** | **316LSS** | 2" NPT |
| **MS528** | 12" - 240" (.3M - 6M) | 12" - 120" (.3M - 3M) | **2 Wire, Loop Power** | **Teflon** | 2" NPT |
| **MS529** | 12" - 240" (.3M - 6M) | 12" - 120" (.3M - 3M) | **2 Wire, Loop Power** | **Kynar** | 2" NPT |
| **MS530** | 12" - 240" (.3M - 6M) | 12" - 120" (.3M - 3M) | **2 Wire, Loop Power** | **CPVC** | 2"NPT |

OPTIONAL ORDERING SYSTEM

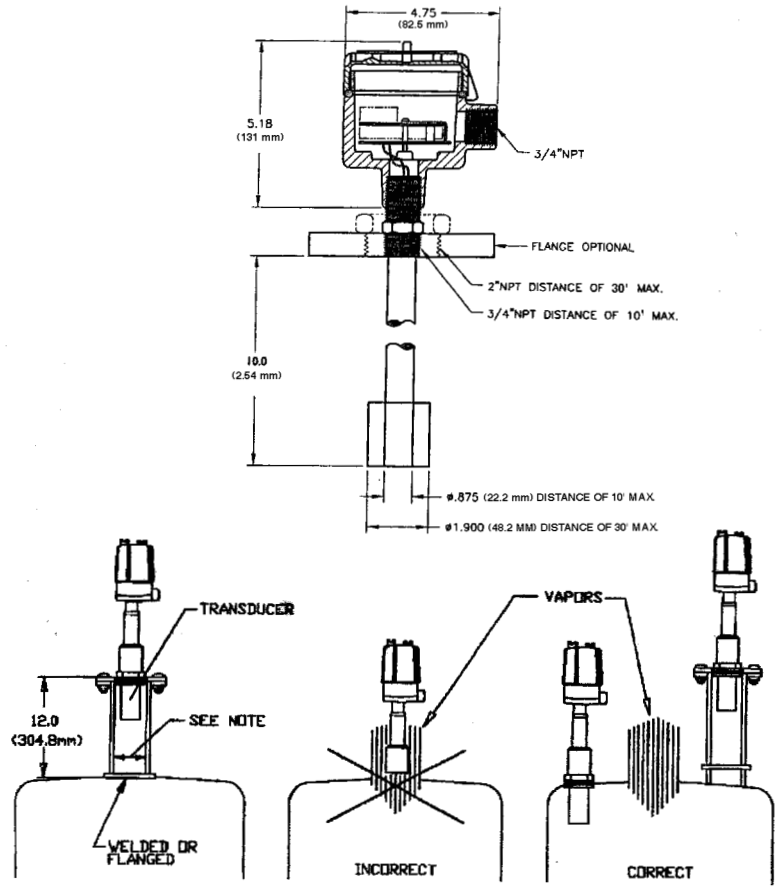


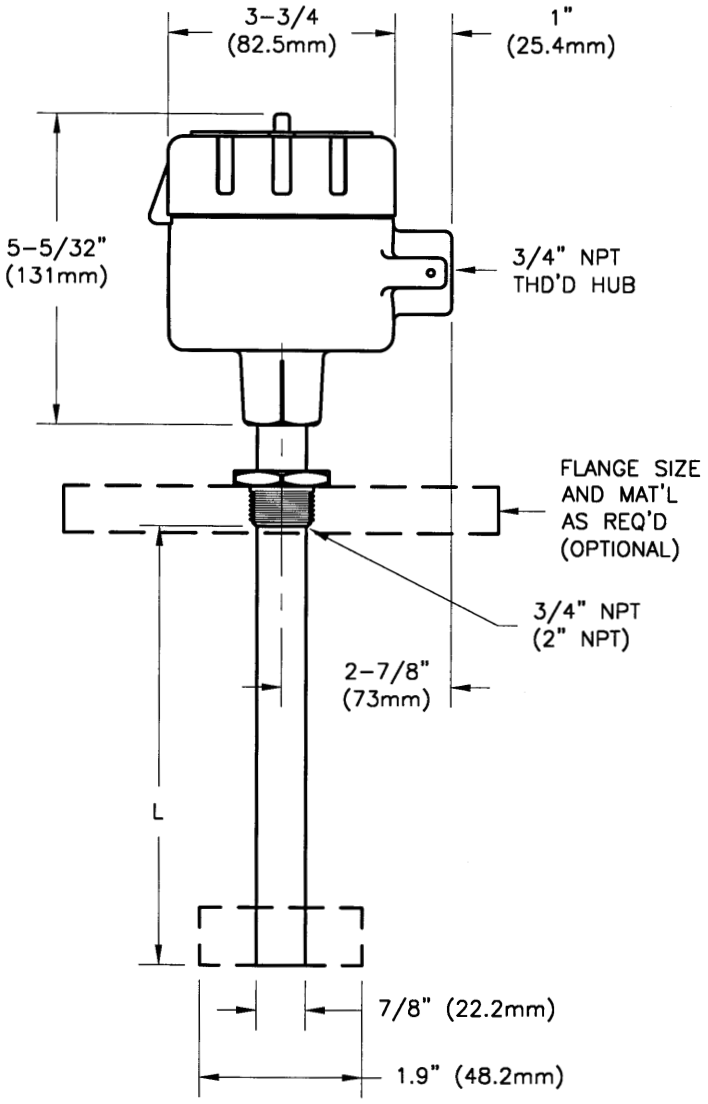

Consult factory for 25 ft. (7.6M) range, electropolishing requirement

## Figure 3
# 2-Wire Wiring Diagram



## Figure 4


4.75
(82.6 mm)
5.18
(131 mm)
3/4"NPT
FLANGE OPTIONAL
2"NPT DISTANCE OF 30' MAX.
3/4"NPT DISTANCE OF 10' MAX.
10.0
(2.54 mm)
ø.875 (22.2 mm) DISTANCE OF 10' MAX.
ø1.900 (48.2 MM) DISTANCE OF 30' MAX.
TRANSDUCER
12.0
(304.8mm)
SEE NOTE
WELDED OR
FLANGED
VAPORS
INCORRECT
CORRECT
SENSOR MOUNTING FOR FULL TANKS
SENSOR MOUNTING FOR TANKS WITH VAPORS
NOTE: MINIMUM 3" (76.20mm) ID FOR 3/4" (19.05mm) SENSOR
MINIMUM 6" (152.40mm) ID FOR 2" (50.8mm) SENSOR


3-3/4
(82.5mm)
1"
(25.4mm)
5-5/32"
(131mm)
3/4" NPT
THD'D HUB
FLANGE SIZE
AND MAT'L
AS REQ'D
(OPTIONAL)
3/4" NPT
(2" NPT)
2-7/8"
(73mm)
L
7/8" (22.2mm)
1.9" (48.2mm)

# 6 SYSTEM CONFIGURATION DOCUMENT

SITE/LOCATION ID: _____

JOB: _____

UNIT SERIAL NUMBER: _____ DATE: _____

_____

PROGRAMMABLE PARAMETERS, PROGRAMMED BY: _____

HEIGHT MODE: ❑

DISTANCE MODE: ❑

ANALOG OFFSET: ❑ Y ❑ 4-20mA ❑ 2-10V

❑ N ❑ 0-20mA ❑ 0-10V

LOST ECHO MODE: ❑ 0 ❑ l ❑ 2

❑ STD. ALARM ❑ AUTOMATIC FILL ❑ AUTOMATIC EMPTY

ZERO _____ inches from sensor face

SPAN _____ inches from zero

Series 900/960 transmitter is pending FM approval for use in an intrincally safe circuit per the instructions on drawing 94-900-010. This drawing as well as a description of the intrinsically safe barrier to be used with the transmitter are shown at the right.

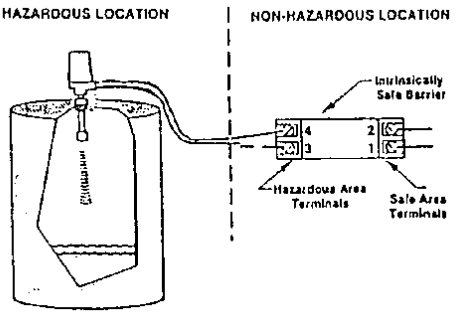
Refer to agency approvals for additional information.

*Approval pending.

**Drawing 94-900-010**
**Entity Parameters:**

| | | | |
|---|---|---|---|
| Vmax- | 36 VDC | Imax- | 150 mA |
| CI- | 0 uF | Li- | 54uH |

## Intrinsic Safety




The voltage (Vmax) and current (lmax) which the transmitter can receive must be equal or greater than the maximum open circuit voltage (Voc) and the maximum short circuit current (lsc) which can be delivered by the source device. In addition, the maximum capacitance (Cl) and inductance (U) of the load and the capacitance and inductance of the interconnecting wiring, must be equal to or less than the capacitance (Ca) or the inductance (la) which can be driven by the source device.